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Fact Sheet

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Rare Vertebrate Species Richness

These EnviroAtlas national maps display the number of rare vertebrate species with potential habitat within each 12-digit hydrologic unit (HUC) in the conterminous United States. These data are based on habitat models, not wildlife counts.

Why are rare vertebrate species important?

The metric, Rare Vertebrate Species Richness estimates the number of rare species that may inhabit an area based on potential habitat. For this map, rare species were considered to be 25% of vertebrate species in the U.S. with the smallest amount of predicted habitat.[1] Species richness is one measure of biodiversity that can represent the relative conservation value of a particular area. Many scientists believe that biodiversity, because it represents all forms of life on earth, provides or supports the core benefits that humans derive from their environment to sustain human society, economy, health, and well-being. Managing for biodiversity is one way to balance competing demands for ecosystem services.[2] Rarity identifies species that may be in need of focused conservation efforts including habitat protection and management.[3] Rarity and endemism can be used interchangeably to indicate species susceptible to stresses with small geographic ranges.[1]

Each species plays an important role within its ecosystem, and ecosystems are highly interconnected. Each species depends on others for some aspect of its survival to provide food, habitat, decomposition, pollination, or control of pest species. The removal of even one species from an ecosystem can create a trophic cascade that can affect the entire food chain. For example, grazers and browsers directly modify the species composition, diversity, and condition of grassland and forest habitats. Top predators, by regulating herbivore numbers, indirectly influence habitat condition and diversity by reducing grazing pressure on plant production.[4]

Characteristics of biodiversity are valued in a variety of ways and thus they are important to include in any assessment that seeks to identify and quantify the value of ecosystems to humans. Some biodiversity metrics clearly reflect ecosystem services and their contribution to our quality of life and economy (e.g., abundance and diversity of game species), whereas others reflect indirect and difficult-to-quantify relationships to services (e.g., relevance of species diversity to ecosystem resilience, cultural value, and aesthetics).

In addition to their roles within ecosystems, vertebrates are economically and culturally important. Watchable wildlife opportunities raise environmental awareness in the general public, attracting visitors to parks and other wildlife management areas. Hunting has a long tradition in the U.S. Vertebrate species such as big game animals and birds are often featured in tourist brochures to highlight the recreational opportunities available within an area. Vertebrate species richness has been used as an indicator of the biodiversity conservation potential of an area and is considered an important indicator of biodiversity hot spots.

Photo: New England cottontail, T. Barnes, USFWS

How can I use this information?

Three EnviroAtlas maps, Mean, Maximum, and Normalized Index of Biodiversity (NIB), illustrate rare vertebrate species richness for each 12-digit HUC in the conterminous United States.[4] Used together or independently, these maps can help identify areas of low or high potential species richness to help inform decisions about resource restoration, use, and conservation. Mean richness is a commonly used and understood value for comparison. NIB provides an index to compare a metric with other metrics across multiple project scales simultaneously. Maximum richness identifies areas that are species rich but may not occupy large areas (e.g. linear riparian areas).

These maps can be used in conjunction with other EnviroAtlas maps such as ecoregions, the U.S. Geological Survey (USGS) protected areas database (PAD-US), or the USGS Gap Analysis Project (GAP) ecological systems to identify areas with high ecological or recreational value for conservation, recreation, or restoration planning. After learning the rare total vertebrate species richness values for a particular 12-digit

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HUC, users can investigate an area more intensively by using individual species models available from the GAP Project.

How were the data for this map created?

The USGS GAP project maps the distribution of natural vegetation communities and potential habitat for individual terrestrial vertebrate species. These models use environmental variables (e.g., land cover, elevation, and distance to water) to predict habitat for each species. GAP modeled habitat for 1,590 terrestrial vertebrate species that reside, breed, or use the habitat within the conterminous U.S. for a significant portion of their life history. For this map, rare species were considered to be 25% of all the terrestrial vertebrate species within the conterminous U.S. with the smallest amount of predicted habitat modeled by GAP.

Predicted habitat for the resulting 398 individual vertebrate species was combined to calculate rare total vertebrate species richness by pixel. Of the 398 species, 152 were amphibians, 85 were birds, 61 were mammals, and 100 were reptiles. The mean and maximum numbers of terrestrial vertebrate species in each 30-meter pixel were calculated for each 12-digit HUC. The mean species richness value by HUC was divided by the maximum mean value within all HUCs to calculate the NIB.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. These data, based on models and large national geospatial databases of predicted habitat, are estimations of reality that may overestimate actual species presence. Modeled data are intended to complement rather than replace monitoring data. Habitat models do not predict the actual occurrence of species, but rather their potential occurrence based on their known associations with certain habitat types. Habitat is only one factor that determines the actual presence of a species. Other factors include habitat quality, predators, prey, competing species, and fine scale habitat features. Other essential species information in addition to species richness includes the types of species and their functional groups, whether they are rare or common, native or non-native, tolerant or intolerant of disturbance.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Individual 30-meter pixel data may be downloaded from the New Mexico State University Center for Applied Spatial Ecology.

Where can I get more information?

A selection of resources related to terrestrial vertebrates and biodiversity is listed below. Information on the models and data used in the USGS Core Science Analytics, Synthesis & Library's GAP project is available on their website. For additional information on how the data were created, access the metadata for the data layer from the layer list drop down menu. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

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5. Kepner, W.G., K.G. Boykin, D.F. Bradford, A.C. Neale, A.K. Leimer, and K.J. Gergely. 2011. Biodiversity metrics fact sheet, EPA/600/F-11/006, U.S. Environmental Protection Agency, Washington, D.C.